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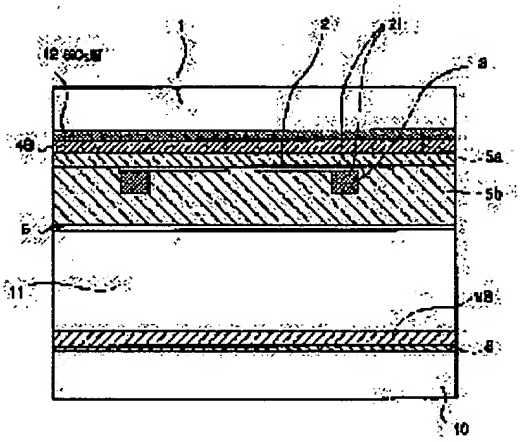
(54) COLOR PLASMA DISPLAY PANEL

(57)Abstract:

PROBLEM TO BE SOLVED: To solve unevenness of the driving voltage due to the difference of respective pigments for red-, green-, and blue-colors for color filters in an AC type color plasma display panel for which the color filters are employed.



SOLUTION: The structure of a front face substrate 1 is composed of a SiO2 layer 12, color filter layers 4B, a transparent dielectric layer 5a, a face discharge electrode 2H, a transparent dielectric layer 5b, and a protective layer 6 formed in this order from the glass substrate side. The SiO2 layer formed on the front face substrate 1 may be omitted in the case the treatment temperature of the substrate is low. A material having higher softening point by 50°C or more than the material for the transparent dielectric layer 5b is used for the dielectric transparent layer 5a. Optionally, the structure of a front faced substrate 1 may be composed of a SiO2 layer, color filter layers 4B, a crystallized glass layer or glass plate, a face discharge electrode, a transparent dielectric layer, and a protective layer formed in this order from the glass substrate side and the glass plate may be soda-lime glass coated with SiO2 or alkali-free glass.

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CLAIMS

[Claim(s)]
[Claim 1] The field discharge electrode group more than the pair which consists of a bus electrode formed so that at least a part may touch a transparent electrode and it, In AC side discharge mold color plasma display panel which carried out opposite arrangement of the 2nd substrate which has the 1st substrate which has the transparence dielectric layer which covers an electrode group, and a data electrode and the fluorescent substance which performs visible luminescence of two or more colors The structure of said 1st substrate The color filter layer from a glass substrate side, the 1st transparence dielectric layer, The color plasma display panel which considers as the order of a field discharge electrode and the 2nd transparence dielectric layer, and is characterized by the softening temperature of said transparence dielectric layer being higher than the softening temperature of said 2nd transparence dielectric layer 50 degrees C or more.
[Claim 2] The field discharge electrode group more than the pair which consists of a bus electrode formed so that at least a part may touch a transparent electrode and it, In AC side discharge mold color plasma display panel which carried out opposite arrangement of the 2nd substrate which has the 1st substrate which has the transparence dielectric layer which covers an electrode group, and a data electrode and the fluorescent substance which performs visible luminescence of two or more colors The structure of said 1st substrate A glass substrate side to SiO2, a color filter layer, The color plasma display panel which forms in order of the 1st transparence dielectric layer, a field discharge electrode, and the 2nd transparence dielectric layer, and is characterized by the softening temperature of said 1st transparence dielectric layer being higher than the softening temperature of said 2nd transparence dielectric layer 50 degrees C or more.
[Claim 3] It is the color plasma display panel characterized by said 1st transparence dielectric layer using amorphous glass as a principal component in claim 1 or a color plasma display panel according to claim 2.
[Claim 4] The field discharge electrode formed in a color plasma display panel according to claim 3 between said 1st transparence dielectric layer and said 2nd transparence dielectric layer is a color plasma display panel characterized by forming a transparent electrode on said 1st transparence dielectric layer, and forming a bus electrode on said transparent electrode.
[Claim 5] The field discharge electrode formed in a color plasma display panel according to claim 3 between said 1st transparence dielectric layer and said 2nd transparence dielectric layer is a color plasma display panel characterized by forming a bus electrode on said 1st transparence dielectric layer, and forming a transparent electrode so that at least a part may touch said bus electrode.
[Claim 6] The field discharge electrode group more than the pair which consists of a bus electrode formed so that at least a part may touch a transparent electrode and it, In AC side discharge mold color plasma display panel which consists of the 2nd substrate which has the 1st substrate which has the transparence dielectric layer which covers an electrode group, and a data electrode and the fluorescent substance which performs visible luminescence of two or more colors The color plasma display panel characterized by forming the structure of said 1st substrate from a glass substrate side in order of a color

filter layer, a glass-ceramics layer, a field discharge electrode, and a transparence dielectric layer.
[Claim 7] The field discharge electrode group more than the pair which consists of a bus electrode formed so that at least a part may touch a transparent electrode and it, In AC side discharge mold color plasma display panel which consists of the 2nd substrate which has the 1st substrate which has the transparence dielectric layer which covers an electrode group, and a data electrode and the fluorescent substance which performs visible luminescence of two or more colors The color plasma display panel characterized by forming the structure of said 1st substrate from a glass substrate side in order of SiO2, a color filter layer, a glass-ceramics layer, a field discharge electrode, and a transparence dielectric layer.
[Claim 8] The field discharge electrode formed between a glass-ceramics layer and a transparence dielectric layer in claim 6 or a color plasma display panel according to claim 7 is a color plasma display panel characterized by forming a transparent electrode on said crystallization glass layer, and forming a bus electrode on said transparent electrode.
[Claim 9] The field discharge electrode formed between a crystallization glass layer and a transparence dielectric layer in claim 6 or a color plasma display panel according to claim 7 is a color plasma display panel characterized by forming a bus electrode on said crystallization glass layer, and forming a transparent electrode so that at least a part may touch said bus electrode.
[Claim 10] The field discharge electrode group more than the pair which consists of a bus electrode formed so that at least a part may touch a transparent electrode and it, In AC side discharge mold color plasma display panel which consists of the 2nd substrate which has the 1st substrate which has the transparence dielectric layer which covers an electrode group, and a data electrode and the fluorescent substance which performs visible luminescence of two or more colors The color plasma display panel characterized by forming the structure of said 1st substrate from a glass substrate side in order of a color filter layer, a glass plate, a field discharge electrode, and a transparence dielectric layer.
[Claim 11] The field discharge electrode group more than the pair which consists of a bus electrode formed so that at least a part may touch a transparent electrode and it, In AC side discharge mold color plasma display panel which consists of the 2nd substrate which has the 1st substrate which has the transparence dielectric layer which covers an electrode group, and a data electrode and the fluorescent substance which performs visible luminescence of two or more colors The color plasma display panel characterized by forming said 1st substrate from a glass substrate side in order of SiO2, a color filter layer, a glass plate, a field discharge electrode, and a transparence dielectric layer.
[Claim 12] In claim 10 or a color plasma display panel according to claim 11, a glass plate is soda lime glass, and it is it SiO2 Color plasma display panel characterized by carrying out a coat.
[Claim 13] It is the color plasma display panel characterized by a glass plate being alkali free glass in claim 10 or a color plasma display panel according to claim 11.
[Claim 14] The field discharge electrode formed between a glass plate and a transparence dielectric layer in claim 12 or a color plasma display panel according to claim 13 is a color plasma display panel characterized by forming a transparent electrode on said glass plate, and forming a bus electrode on said transparent electrode.
[Claim 15] The field discharge electrode formed between a glass plate and a transparence dielectric layer in claim 12 or a color plasma display panel according to claim 13 is a color plasma display panel characterized by forming a bus electrode on said glass plate, and forming a transparent electrode so that at least a part may touch said bus electrode.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention] This invention relates to the panel structure with especially sufficient high contrast and color reproduction nature of the color plasma display panel used for an information-display terminal, flat-surface mold television, etc.
[0001]
[Description of the Prior Art] A color plasma display panel is a display to which excitation luminescence is carried out and the display action of the fluorescent substance is carried out by the ultraviolet rays generated by the discharge in gases. It can divide into AC mold and DC mold from the gestalt of discharge. In this, AC mold is excellent in respect of [mold / DC] brightness, luminous efficiency, and a life, and the reflective mold AC side discharge mold is excellent in respect of brightness and luminous efficiency also in AC mold. The sectional view in the d-d' line of drawing 4 is shown for the perspective view of an example of the conventional reflective mold AC side discharge color plasma display panel in drawing 4 again at drawing 5 . The transparent electrode 2 of the shape of two or more stripe is formed in the front substrate 1 of transparent glass. In drawing 5 , two or more [of this transparent electrode 2] are formed perpendicularly at space. Between this adjacent transparent electrode 2, the pulse-like AC electrical potential difference of dozens of kHz to hundreds of kHz is impressed, discharge is generated, and a display action is performed.
[0002] In a reflective mold AC side discharge color plasma display, transparence electric conduction film, such as tin oxide (SnO2) and indium tin oxide (ITO), is usually used for a transparent electrode 2 so that [luminescence from a fluorescent substance] it may not be interrupted. However, the sheet resistance of these transparence electric conduction film is high, by the large-sized panel or the highly minute panel, electrode resistance becomes also more than several 10komega, an applied-voltage pulse does not fully start or a lifting drive becomes difficult about a voltage drop. Then, the bus electrode 3 by metal thickness film, such as metal thin films, such as a multilayered film of chromium / copper / chromium and an aluminum thin film, or silver, is formed in the part of a transparent electrode 2, and field discharge electrode 2H which consist of the transparent electrode 2 and the bus electrode 3 which lowered resistance are adopted as it.
[0003] On these field discharge electrode 2H, the color filter layers 4R, 4G, and 4B which consist of a stripe-like pigment impalpable powder layer so that it may intersect perpendicularly with field discharge electrode 2H are formed. Generally, the ingredient which has the optical property which penetrates only the luminescent color of the fluorescent substance layer 9 which this color filter layer 4 counters is chosen. Furthermore, this color filter layer 4 is covered with the transparent dielectric layer 5. This transparence dielectric layer 5 has the function of current limiting peculiar to AC mold plasma display. This is the function in which field discharge stops, when the potential by the electrical potential difference to which the field discharge which forms a capacitor by field discharge electrode 2H and the transparence dielectric layer 5, and is performed among [of two] field discharge electrode 2H is impressed by field discharge electrode 2H, and the charge stored in the transparence dielectric layer 5 by discharge denies exactly and there is. Thereby, the current has prevented flowing superfluously.

Moreover, from reservation of withstand voltage, and the ease of carrying out of manufacture, the transparence dielectric layer 5 applies the paste which usually uses low melting glass as a principal component using thick film printing, and it carries out a reflow by calcinating at the elevated temperature beyond softening temperature temperature, and it forms it in the interior by the smooth thickness of 20 micrometers - about 40 micrometers which does not contain air bubbles etc.
[0004] Next, the protective layer 6 formed so that the whole transparence dielectric layer 5 may be covered is the thick film of MgO formed by the thin film of MgO or printing formed by vacuum evaporationo or the sputtering method, a spray method, etc. Thickness is about 1 micron from 0.5 microns. The roles of this protective layer 6 are reduction of discharge voltage, and prevention of a surface spatter.
[0005] On the other hand, the data electrode 8 of the shape of a stripe which writes in an indicative data is formed in the rear-face substrate 10. It is formed in the location corresponding to the red in which the data electrode 8 was formed in the direction parallel to space elongation and in the shape of [which this mentions later] a stripe, and the fluorescent substance layer 9 and each which emit light by the ultraviolet rays of discharge green and blue in drawing 5 . That is, the data electrode 8 lies at right angles to field discharge electrode 2H formed on the front substrate 1. The septum 7 was usually formed by thick film screen printing so that it might not lap with this data electrode 8, by carrying out thick film screen printing of the paste which usually becomes the upper part of a septum from metallic-oxide powder, low melting glass, etc., such as iron, chromium, and nickel, further etc., it colored black and reflection in a bright place is prevented. Moreover, a septum 7 has the effectiveness which prevents the discharge and the optical cross talk between the adjoining discharge cels. In drawing 5 , two or more [of this septum] are formed in parallel with space.
[0006] Furthermore, for every color, the fluorescent substances 9R, 9G, and 9B corresponding to red and the green and blue luminescent color are divided into 3 times, and are applied to the discharge cel 11 which consists of a septum 7, a front substrate 1, and a rear-face substrate 10. Each fluorescent substance is formed also in the side face of a septum 7, in order to increase fluorescent substance spreading area and to obtain high brightness. Screen-stencil is usually used for membrane formation of each fluorescent substance.
 [0007] Then, it is made to counter through a septum and the hermetic seal of the perimeter is carried out so that field discharge electrode 2H of the above-mentioned front substrate 1 and the data electrode 8 of the rear-face substrate 10 may intersect perpendicularly, and the gas which can discharge inside the discharge cel 11, for example, the mixed gas of helium, and Ne and Xe, is enclosed by the pressure of 500torr extent.
[0008] In drawing 5 , two field discharge electrode 2H which become each discharge cel 11 from a transparent electrode 2 and the bus electrode 3 are arranged at a time, field discharge occurs in this gap section that is field discharge electrode 2H, and the plasma arises in each discharge cel. Fluorescent substances 9R, 9G, and 9B are excited by the ultraviolet radiation generated at this time, red and the green and blue light are generated, and display luminescence is obtained through the color filter layer 4 of the front substrate 1.
[0009] The lot of adjacent field discharge electrode 2H which generate field discharge takes charge of the duty of a scan electrode and a maintenance electrode, respectively. In the actual panel drive, the maintenance pulse is impressed between the scan electrode and the maintenance electrode. When generating write-in discharge, an electrical potential difference is impressed between a scan electrode and the data electrode 8, opposite discharge is generated, and maintenance discharge occurs among field discharge electrode 2H by the maintenance pulse to which this discharge is impressed succeedingly.
[0010] The body color of the fluorescent substance used with a color plasma display panel is usually the powder of white with a very high reflection factor. In a color plasma display panel, although outdoor daylight will be absorbed by the septum upper part or the bus polar zone if the light (outdoor daylight) of the interior of a room or the outdoors carries out incidence to a panel, 30% to about 50%, it is reflected and contrast is spoiled remarkably. In order to prevent this outdoor daylight reflection and to obtain the good display of contrast, the approach of arranging the ND filter of about 40 - 80% of permeability is also in a panel side, but since a part of visible luminescence from a fluorescent substance

is also interrupted, there is a fault that panel brightness falls.
[0011] The approach using the color filter layer 4 as an approach of suppressing reflection of outdoor daylight is proposed from the former, without reducing panel brightness as much as possible. This forms the color filter layer 4 which penetrates red and a green and blue light to the front substrate 1 side corresponding to red and the luminescent color from each green and blue discharge cel. High color reproduction nature can be obtained to high contrast and coincidence by this.
[0012] However, as mentioned above, the dielectric layer 5 has the function of current control peculiar to AC mold plasma display. It is greatly dependent on the dielectric constant and thickness of the transparence dielectric layer 5, and this current control function forms the capacitor by field discharge electrode 2H and the transparence dielectric layer 5. However, if the color filter layer 4 is formed between field discharge electrode 2H and the transparence dielectric layers 5 and in the interior of the transparence dielectric layer 5, electrostatic capacity will become that in which the transparence dielectric layer 5 and the color filter layer 4 carried out serial composition. The color filter layer 4 consists of ingredients different, respectively which enable the transparency only of red and green and blue colored light. For example, the following can be considered as red and a green and blue pigment. red: -- Fe 2O3 system green: -- CoO-aluminum2 O3-Cr 2O3 system blue: -- CoO-aluminum 2O3 a system -- dielectric constants differ with each ingredient of each [these] color. That is, the electrostatic capacity which consists of a transparence dielectric layer 5 and a color filter layer 4 in each color will differ, the electrical potential difference by which a current control function and field discharge are started as a result changes with each colors, and a uniform drive becomes very difficult. Moreover, the rise of driver voltage also breaks out.
[0013] JP,6-5202,A is known as an AC mold plasma display using the color filter for solving this problem.
[0014] According to this technique, a color filter layer and a black matrix are formed on a front plate, and the electrode is formed on it. However, if an electrode is directly formed on a color filter layer and a black matrix as this technique has described, an electrode will go out with the irregularity by the color filter layer and black matric. If the electrode is formed by thin film technologies, such as the sputtering method, the thickness is about 1-2 micrometers at the maximum. However, in this thickness, an electrode will go out with the irregularity formed by the color filter layer and black matric. If a dielectric layer will be printed and it will be calcinated on an electrode even if a piece is not generated at the time of membrane formation, when expansion of the color filter layer 4 and the transparence dielectric layer 5 differs, it is clear for a piece to be generated in an electrode and not to function on it as an electrode. Moreover, for irregularity with a color filter layer and a black mask, supposing it is formed with thick-film techniques, such as screen printing, although printed by the part of a convex, the phenomenon in which it is not printed will occur, a piece will be too generated in an electrode, and the part of concave cannot perform the work as an electrode.
[0015] Moreover, a color filter is formed on a front substrate at JP,3-196446,A, a it top is covered by transparence glass membrane, and the technique which forms an electrode on the transparence glass membrane is shown. This technique is DC mold color plasma display panel, and it is impossible to apply this to a direct AC mold. It is because there is the need of forming on an electrode the transparence dielectric layer which uses glass as a principal component, in AC mold color plasma display panel. The transparence glass membrane by this technique applies a paste, and forms it by calcinating at 580 degrees C. If the temporarily same quality of the material as the transparence glass membrane currently used for the bottom of a color filter layer is formed also on an electrode and it calcinates at the same temperature, a piece will be generated in an electrode or a color filter layer. Though an electrode is the quality of the material formed by the thin film technology by the sputtering method etc., even if this is formed with thick-film techniques, such as screen printing, it is the same. The burning temperature of the transparence glass membrane formed on an electrode is because it must be more than the softening temperature of the glass component contained during this paste. If this burning temperature is lower than softening temperature, the transparence glass membrane on an electrode will not carry out a reflow completely, but air bubbles etc. exist in the film, and it becomes a poor proof pressure and the cause of a

permeability fall. Therefore, the burning temperature of the transparence glass membrane on an electrode must be the temperature more than softening temperature. However, since the softening temperature of the transparence glass membrane used for the bottom of an electrode is the same as the object used on the electrode, when calcinating and carrying out a reflow of the transparence glass membrane on an electrode, a re-reflow also keeps the transparence glass membrane under an electrode as **, and, as a result, a piece generates it in an electrode or a color filter layer. Therefore, the ingredient with which the softening temperatures of the transparence glass membrane which forms this technique on an electrode the bottom of an electrode when adapted for AC mold differed must be used. However, according to this technique, that is not suggested at all. Moreover, if a color filter layer is formed on a front substrate and 580 degrees C is calcinated at a subsequent process, alkali metal (mainly Na) will deposit from a glass substrate, and discoloration of a color filter layer will occur. However, it is not suggested at all about this thing.

[0016] Furthermore, a color filter is formed on a front substrate at JP,4-352104,A, a it top is covered by the protective coat (thermosetting matter), and the transparence electric conduction film is formed on it. However, when membrane formation temperature of T1 and the transparence electric conduction film is set to T2 for the membrane formation temperature of a protective coat, the technique characterized by filling T1 >=T2 is indicated. This is a technique for preventing gas's occurring [causes of generating, such as KAKE of a transparent electrode, separation, and poor adhesion,] from a protective coat at the time of transparence electric conduction film membrane formation, or the hardening reaction of a protective coat advancing at the time of transparence electric conduction film membrane formation, and the volumetric shrinkage or cubical expansion of a protective coat happening, and generating Siwa, a swell, an opening, etc. in the critical field of a protective coat and the electric conduction film. However, supposing it applies this technique to AC mold color plasma display panel, the following problems will occur. That is, it is necessary to form a dielectric layer on the transparence electric conduction film in AC mold color plasma display panel. This is because it is necessary to form a capacitor by the electrode and the dielectric layer as mentioned above. When burning temperature of the dielectric layer temporarily formed on the transparence electric conduction film is made into T3, in order not to make the transparence electric conduction film generate a crack, it is T1>T3 and it is important a volumetric shrinkage, cubical expansion, or that a protective layer does not soften at burning temperature T2 (membrane formation temperature of the transparence electric conduction film), and T3 (burning temperature of a dielectric layer). That is, if the substrate of the transparence electric conduction film moves, it will lead to the crack of the transparence electric conduction film. Therefore, when forming the transparence electric conduction film between a protective layer and a dielectric layer, the protective layer of important one is a volumetric shrinkage, cubical expansion, or the temperature to soften. However, this thing is not suggested to this technique at all.

[0017]

[Problem(s) to be Solved by the Invention] In the case of AC mold color plasma display panel, as mentioned above, a transparence dielectric layer has a current control function, and is a very important part. If a color filter layer is formed between a field discharge electrode and a transparence dielectric layer and in the interior of a transparence dielectric layer, the electrostatic capacity of a transparence dielectric layer will become that in which the transparence dielectric layer and the color filter layer carried out serial composition. However, it is blue, and red, green, and since it differs, these electrostatic capacity will differ in each color, and, as for the ingredient of a color filter layer, uniform actuation becomes difficult by this at the time of the drive of a panel. Moreover, the rise of driver voltage also breaks out.

[0018] Moreover, if a color filter layer is first formed on a front substrate and a field discharge electrode is formed on it in order to avoid this, with the irregularity of a color filter layer and the black matrix film, a piece will be generated in a field discharge electrode and the function as an electrode will become impossible.

[0019] Furthermore, when the ingredient same when an electrode is further formed on it after forming a color filter layer and the black matrix film on the front substrate and forming transparence glass

membrane on it as the thing in which the glass membrane which forms this as a dielectric layer on an electrode temporarily when adapted for AC mold color plasma display panel was formed to the bottom of an electrode is used, the following problems occur. When the burning temperature of the transparence glass membrane on an electrode is calcinated at the temperature more than softening temperature, even if the temperature is lower than the burning temperature of the transparence glass membrane formed in the bottom of an electrode, a re-reflow of the transparence glass membrane under an electrode will be carried out, therefore a piece will be generated in an electrode. Moreover, when the burning temperature of the transparence glass membrane on an electrode is calcinated at temperature lower than softening temperature, a reflow cannot be carried out, but, as a result, air bubbles are generated in transparence glass membrane, and the glass membrane on an electrode becomes decline in permeability, and the cause of poor withstand voltage.

[0020] This invention offers AC mold color plasma display panel using the color filter which can realize this structure by determining correlation of the quality of the material of the protective layer at the time of carrying out a laminating to a color filter layer, a protective layer, a field discharge electrode, and a transparence dielectric layer, and the quality of the material of a protective layer and a transparence dielectric layer on a front substrate.

[0021]

[Means for Solving the Problem] In order to solve the problem mentioned above, according to the AC mold color plasma display panel of this invention, structure of a front substrate is used as a color filter layer, the 1st transparence dielectric layer, a field discharge electrode, and the 2nd transparence dielectric layer from a glass substrate side, and the quality of the material of the 1st transparence dielectric layer and the 2nd transparence dielectric layer is determined that the softening temperature of the 1st transparence dielectric layer will become high 50 degrees C or more rather than the softening temperature of the 2nd transparence dielectric layer. however, especially, when the processing temperature of the 1st transparence dielectric layer is high In order to prevent the alkali metal in a glass substrate depositing by baking, and making a color filter layer discolor, it is SiO2 to a glass substrate. The film is prepared. It considers as the structure of a color filter layer, the 1st transparence dielectric layer, a field discharge electrode, and the 2nd transparence dielectric layer on it, and the quality of the material of the 1st transparence dielectric layer and the 2nd transparence dielectric layer is determined so that the softening temperature of the 1st transparence dielectric layer may become high 50 degrees C or more rather than the softening temperature of a transparence dielectric layer. Moreover, it is characterized by the 1st transparence dielectric layer being amorphous glass, and is characterized by for a field discharge electrode forming a transparent electrode on the 1st transparence dielectric layer, and forming a bus electrode on the transparent electrode, or forming a bus electrode on the 1st transparence dielectric layer, and forming a transparent electrode so that at least a part may touch the bus electrode.

[0022] Or let structures of a front substrate be a color filter layer, a glass-ceramics layer, a field discharge electrode, and a transparence dielectric layer from a glass substrate side. However, in order to prevent the alkali metal in a glass substrate depositing by baking, and making a color filter layer discolor, when the processing temperature of a substrate is high, it is SiO2 to a glass substrate. The film is prepared and it considers as the structure of a color filter layer, a glass-ceramics layer, a field discharge electrode, and a transparence dielectric layer on it. Moreover, it is characterized by for a field discharge electrode forming a transparent electrode on a crystallization glass layer, and forming a bus electrode on the transparent electrode, or forming a bus electrode on a crystallization glass layer, and forming a transparent electrode so that at least a part may touch the bus electrode.

[0023] Furthermore, let structures of a front substrate be a color filter layer, a glass plate, a field discharge electrode, and a transparence dielectric layer from a glass substrate side. However, in order to prevent the alkali metal in a glass substrate depositing by baking, and making a color filter layer discolor, when the processing temperature of a substrate is high, it is SiO2 to a glass substrate. The film is prepared and it considers as the structure of a color filter layer, a glass plate, a field discharge electrode, and a transparence dielectric layer on it. when the glass plate formed on a color filter layer is soda lime glass, in order [moreover,] to suppress a deposit of the alkali metal from a glass plate -- SiO2

the case where form membranes and alkali free glass is used as a glass plate -- a glass plate -- SiO2 etc. -- membrane formation is not performed. Moreover, it is characterized by for a field discharge electrode forming a transparent electrode on a glass plate, and forming a bus electrode on the transparent electrode, or forming a bus electrode on a glass plate, and forming a transparent electrode so that at least a part may touch the bus electrode.

[0024] About the substrate which performs high temperature processing according to the color plasma display panel of this invention, it is SiO2. Form on a front substrate, it is made to function as alkali barrier, and discoloration of a color filter layer is suppressed. Moreover, after forming the 1st transparence dielectric layer (henceforth, a) after forming a color filter layer, and graduating a front face, a field discharge electrode, the 2nd transparence dielectric layer (henceforth, b), and a protective layer are formed. By having formed the transparence dielectric layer a on the color filter layer, a front face is graduated and trouble does not occur in subsequent transparent electrode formation or bus electrode formation. Moreover, the membrane formation temperature of a transparent electrode is about 250 degrees C or less, when membranes are usually formed by the sputtering method, and the burning temperature of the transparence dielectric layer a or the transparence dielectric layer b is 500-600 degrees C to it. For this reason, in case a transparent electrode is formed, the transparence dielectric layer a does not soften and the problem of the piece of a transparent electrode etc. is not generated at the time of transparent electrode membrane formation. Furthermore, if the transparence dielectric layer a does not soften at the time of baking of the transparence dielectric layer b, an open circuit is not generated in the field discharge electrode which consists of a transparent electrode and a bus electrode. The difference of the softening temperature of the transparence dielectric layer a required in order not to soften the transparence dielectric layer a at the time of baking of this transparence dielectric layer b, and the softening temperature of the transparence dielectric layer b is 50 degrees C or more. With the quality of the material in which the transparence dielectric layer a has softening temperature higher 50 degrees C or more than the transparence dielectric layer b Since an open circuit cannot be generated in a field discharge electrode, but the transparence dielectric layer b can be softened completely and air bubbles etc. will not be generated in the transparence dielectric layer b if the transparence dielectric layer b is calcinated near the softening temperature of the transparence dielectric layer b, decline in poor withstand voltage and permeability does not occur, either. Moreover, since the membrane formation temperature of MgO which is a protective layer is usually around 200 degrees C, the transparence dielectric layer a and the transparence dielectric layer b do not soften in membrane formation of MgO. Next, when structure of a front substrate is made into a color filter layer, a glass-ceramics layer, a field discharge electrode, a transparence dielectric layer, and a protective layer from a glass substrate side, even if a front face is graduated and it forms a color filter layer by having prepared the glass-ceramics layer on the color filter layer too, trouble does not occur in field discharge electrode formation at all. Furthermore, if glass ceramics calcinate at 500-600 degrees C, it will re-be hard coming to soften after baking. By this, at the time of membrane formation of a transparent electrode, and formation of a bus electrode, a piece cannot be generated in a field discharge electrode because glass ceramics do not re-soften at the time of baking of the transparence dielectric layer further formed on a field discharge electrode, but a transparence dielectric layer can be softened completely, air bubbles etc. are not generated in a transparence dielectric layer, but the front substrate with which decline in poor withstand voltage and permeability does not occur, either can be formed. Moreover, when carrying out high temperature processing of the substrate, it is SiO2 to a glass substrate. It forms and a deposit of the alkali metal from a glass substrate is suppressed.

[0025] Furthermore, when structure of a front substrate is made into a color filter layer, a glass plate, a field discharge electrode, a transparence dielectric layer, and a protective layer from a glass substrate side, even if a front face is smooth and it forms a color filter layer by having formed the glass plate on the color filter layer, trouble does not occur in field discharge electrode formation at all. Furthermore, a glass plate is not softened at the time of baking of the transparence dielectric layer further formed on a field discharge electrode at the time of membrane formation of a transparent electrode, and formation of a bus electrode, a piece cannot be generated in a field discharge electrode, a transparence dielectric layer

can be softened completely, air bubbles etc. are not generated in a transparence dielectric layer, but the front substrate with which decline in poor withstand voltage and permeability does not occur, either can be formed. Moreover, when carrying out high temperature processing of the substrate, it is SiO2 to a glass substrate and a glass plate. It forms and a deposit of the alkali metal from a glass substrate is suppressed. Moreover, if alkali free glass is used as a glass plate, it will be SiO2 to a glass plate. There is no need of forming.

[0026] By this, since the color filter layer is not formed between a field discharge electrode and a transparence dielectric layer or in the interior of a transparence dielectric layer, the ununiformity of the electrostatic capacity by a color filter ingredient differing from red, green, and blue does not occur, but it crosses all over a panel, and a uniform drive can be performed.

[0027]

[Embodiment of the Invention] The gestalt of operation of the color plasma display panel of this invention is explained using drawing below.

[0028] (Gestalt 1 of operation) At the gestalt of this 1st operation, it is SiO2 on a front substrate. Membranes are formed about 1 micron in thickness, a color filter layer is formed on it, and the case where a laminating is carried out to the transparence dielectric layer a, a transparent electrode, a bus electrode, the transparence dielectric layer b, and a protective layer after that is explained. However, the transparence dielectric layer a used the object which used amorphous glass as the principal component.

[0029] The cross-section structure of the panel at this time is shown in drawing 1 . Drawing 1 is equivalent to the cross section in the d-d' line of drawing 4 shown in the conventional example. Moreover, the rear-face substrate of drawing 1 carries out sequential formation of the data electrode 8, a septum 7, and the fluorescent substances 9R, 9G, and 9B on a glass substrate, as the conventional example showed. The discharge cel 11 which obtains each luminescent color consisted of a data electrode 8 and field discharge electrode 2H which the front substrate 1 which counters through a septum 7 has.

[0030] On the other hand, the front substrate 1 is SiO2. A layer 12, the color filter layers 4R, 4G, and 4B, transparence dielectric layer 5a, a transparent electrode 2, the bus electrode 3, transparence dielectric layer 5b, and a protective layer 6 are formed. At this time, the softening temperature of transparence dielectric layer 5a uses an ingredient higher 50 degrees C or more than the softening temperature of transparence dielectric layer 5b.

[0031] First, it is SiO2 on the front substrate 1. A coat is carried out. The DIP method performed the approach of a coat. The front substrate 1 is dipped into a solution, and a substrate is pulled up and it dries. It is SiO2 by calcinating this substrate at about 550 degrees C. The film is formed on the front substrate 1. The thickness after baking was about 1 micron.

[0032] Next, the color filter layers 4R, 4G, and 4B are formed. The formation approach was performed with screen printing. The paste which prepared the binder and the solvent to the particle pigment of the red which uses ferrous oxide as a principal component is printed in the shape of a stripe. After printing, at about 150 degrees C, the solvent was evaporated and it dried. Next, it prints in parallel with the side of the red-pigments pattern already printed by the green particle pigment which uses the oxide of cobalt, chromium, and aluminum as a principal component using the paste which prepared the binder and the solvent, and dries. It prints in parallel with the side of the green-pigments pattern already printed by the blue pigment which uses the oxide of cobalt and aluminum as a principal component at the last using the paste which prepared the binder and the solvent, and dries. It calcinated, after covering the part which is equivalent to a display with this three pigment printing with the pigment of whole surface each color. Thickness of the color filter layer after baking was made into about 2 microns also with three colors. The particle size of the used inorganic pigment particle is very as fine as about 0.01-0.05 microns, and has become a precise layer.

[0033] Next, transparence dielectric layer 5a is formed on this. The formation approach was performed with screen printing. The paste which uses the amorphous glass of a low-melt point point as a principal component was printed so that the color filter layer 4 might be covered. It calcinated by drying after that. However, the glass frit under paste used at this time used the ingredient with softening temperature

higher 50 degrees C or more than transparence dielectric layer 5b used behind. Burning temperature of this transparence dielectric layer 5a was inevitably performed at temperature higher than the burning temperature of transparence dielectric layer 5b performed behind. Burning temperature of this transparence dielectric layer 5a was made into 550-600 degrees C, and the thickness after baking could be about 10 microns.

[0034] After forming this transparence dielectric layer 5a, a transparent electrode 2 is formed. First, the transparence electric conduction film is formed by solid ones on transparence dielectric layer 5a. Tin oxide (SnO2), indium tin oxide (ITO), etc. can be considered as this transparence electric conduction film. This ITO was used with the gestalt of this operation. Moreover, although the sputtering method, a CVD method, or the print processes that uses what was pasted could be considered as the membrane formation approach, with the gestalt of this operation, membranes were formed by the sputtering method. Membrane formation temperature was made into 150-250 degrees C, and thickness was made into the thickness of about 100-200nm. It etches, after applying a resist after forming the transparence electric conduction film by solid one, and taking the measures of desiccation, exposure, and development, and the form as an electrode is formed. This forms a transparent electrode 2. Next, since there are several 10kohms or more of resistance of a transparent electrode 2 as the conventional example also described, the bus electrode 3 with low resistance is formed. Although chromium / copper / chromium, aluminum or silver, etc. could be considered as an ingredient of the bus electrode 3, silver was used with the gestalt of this operation. Moreover, with the gestalt of this operation, although the formation approach could also consider the thin film by the sputtering method, and the thick film by print processes, since it used silver, it was formed by the print processes which are thick-film techniques. Since what mixed and pasted an organic solvent and resin in the object with which glass powder was mixed in the end of silver dust at this time was used, after forming a pattern by print processes, the adhesion force of the bus electrode 3 was able to be acquired by calcinating at 500-600 degrees C by burning the organic solvent and resin under paste, and making it not remain in a pattern, and softening the glass under paste once by this baking.

[0035] Next, transparence dielectric layer 5b is formed on this. Transparence dielectric layer 5b as well as transparence dielectric layer 5a was performed with screen printing. However, the glass frit used for transparence dielectric layer 5b used the ingredient with softening temperature lower 50 degrees C or more than the object used for transparence dielectric layer 5a as mentioned above. This was calcinated at the temperature of 500-550 degrees C after printing / desiccation. The thickness after baking of this transparence dielectric layer 5b could be about 30 microns.

[0036] When softening temperature of the transparence dielectric layer a was set to Ts (a) and softening temperature of the transparence dielectric layer b was set to Ts (b) here, the electrode condition by the difference of this softening temperature was as in Table 1 as a result of the experiment.

[0037]

[Table 1]

Ts (a) (℃)	Ts (b) (℃)	Ts(a)−Ts(b) (℃)	カラーフィルターの状態	面放電電極断線発生率(%)
543	510	33	○	100
543	500	43	○	100
550	500	50	○	2
550	450	100	○	0

[0038] Here, as a transparence dielectric paste whose softening temperature is 543 degrees C, there are for example, PLS-3243 by Nippon Electric Glass Co., Ltd., and there are NP-4974 by for example, NORITAKE CO., LIMITED etc. as a paste for transparence dielectrics whose softening temperature is 500 degrees C.
[0039] as Table 1 shows, when higher 50 degrees C or more than the softening temperature of the transparence dielectric layer b, an open circuit of an electrode boils the softening temperature of the transparence dielectric layer a markedly, it decreases, and it turns out that it is functioning as a field discharge electrode. In addition, the same result was obtained by the temperature gradient not only with the above-mentioned transparence dielectric paste but the almost same like.
[0040] after forming this transparence dielectric layer 5b -- transparence dielectric layer 5b -- the protective layer 6 which consists of MgO so that all may be covered is formed. MgO formed membranes with vacuum deposition, membrane formation temperature was made into 200 degrees C, and thickness could be 0.5-1 micron.
[0041] Thus, the front substrate 1 is created and a panel is made combining the rear-face substrate 10. However, it cannot be overemphasized that it was made in agreement [each color of the color filter layers 4R, 4G, and 4B created to the front substrate 1 and the luminescent color of the fluorescent substances 9R 9G, and 9B formed in the rear-face substrate 10].
[0042] When this panel was operated, the piece of an electrode could secure high bright place contrast and large color reproduction nature without having not generated and also generating decline in poor withstand voltage and permeability, and was able to cancel the rise of the driver voltage by the color filter, and the ununiformity of the driver voltage by each color filter ingredient (red, green, blue) further. Moreover, discoloration of a color filter layer did not occur, either.
[0043] Moreover, at the gestalt of this operation, it is SiO2 on the front substrate 1. Although the coat of the layer 12 was carried out, this is because the burning temperature of transparence dielectric layer 5a was 550 degrees C or more. When the highest burning temperature of all the processes that manufacture the front substrate 1 is lower than 550 degrees C, even if it does not carry out the coat of this, discoloration of the color filter layer 4 is not generated. Furthermore, although field discharge electrode 2H were formed by forming the bus electrode 3 on a transparent electrode 2 with the gestalt of this operation, even if it forms the bus electrode 3 previously, and it forms so that a transparent electrode 2 may next touch this bus electrode 3, it cannot be overemphasized that the same effectiveness is acquired.

[0044] (Gestalt 2 of operation) With the gestalt of this 2nd operation, a color filter layer is formed on a front substrate, and the case where a laminating is further carried out to a crystallization glass layer, a transparent electrode, a bus electrode, a transparence dielectric layer, and a protective layer is explained. The cross-section structure of the panel at this time is shown in drawing 2 . Drawing 2 is equivalent to the cross section in the d-d' line of drawing 4 shown in the conventional example. Moreover, the rear-face substrate of drawing 2 carries out sequential formation of the data electrode 8, a septum 7, and the fluorescent substances 9R, 9G, and 9B on a glass substrate, as the conventional example showed. The discharge cel 11 which obtains each luminescent color consisted of a data electrode 8 and field discharge electrode 2H which the front substrate 1 which counters through a septum 7 has.
[0045] On the other hand, the front substrate 1 forms the color filter layers 4R, 4G, and 4B, the crystallization glass layer 13, a transparent electrode 2, the bus electrode 3, transparence dielectric layer 5b, and a protective layer 6.
[0046] First, the color filter layers 4R, 4G, and 4B are formed on the front substrate 1. Since it is the same as that of the gestalt of the 1st operation, the formation approach is omitted.
[0047] Next, the glass-ceramics layer 13 is formed on this. The formation approach was performed with screen printing. It printed so that the color filter layer 4 might be covered with the paste which uses glass ceramics as a principal component. It dried after that and calcinated at 500-600 degrees C. However, since the permeability of glass ceramics of light was bad, they made thickness after baking 5 microns or less.
[0048] After forming this glass-ceramics layer 13, a transparent electrode 2 is formed. However, since it

is the same as that of the gestalt of the 1st operation, the formation approach of a transparent electrode 2 and the bus electrode 3 is omitted.
[0049] After forming a transparent electrode 2 and the bus electrode 3, the transparence dielectric layer 5 is formed. The transparence dielectric layer 5 as well as the glass-ceramics layer 13 was performed with screen printing. This was calcinated at the temperature of 500-600 degrees C after printing / desiccation. The thickness after baking of this transparence dielectric layer 5 could be about 30 microns. after forming this transparence dielectric layer 5 -- the transparence dielectric layer 5 -- the protective layer 6 which consists of MgO so that all may be covered is formed. MgO formed membranes with vacuum deposition, membrane formation temperature was made into 200 degrees C, and thickness could be 0.5-1 micron.
[0050] Thus, the front substrate 1 is created and a panel is made combining the rear-face substrate 10. However, it cannot be overemphasized that it was made in agreement [each color of the color filter layers 4R, 4G, and 4B created to the front substrate 1 and the luminescent color of the fluorescent substances 9R, 9G, and 9B formed in the rear-face substrate 10].
[0051] When this panel was operated, the piece of an electrode was not able to be generated, was not able to generate decline in poor withstand voltage and permeability, either, but could secure high bright place contrast and large color reproduction nature, and was able to cancel the rise of the driver voltage by the color filter, and the ununiformity of the driver voltage by each color filter ingredient (red, green, blue) further. Moreover, discoloration of a color filter layer did not occur, either.
[0052] Moreover, at the gestalt of this operation, it is SiO2 to the front substrate 1. It is SiO2 like [although a coat has not been carried out / when the highest burning temperature exceeds 550 degrees C among the production processes of a front substrate] the gestalt of the 1st operation. It is necessary to prepare a layer. Furthermore, although field discharge electrode 2H were formed by forming the bus electrode 3 on a transparent electrode 2 with the gestalt of this operation, even if it forms the bus electrode 3 previously, and it forms so that a transparent electrode 2 may next touch this bus electrode 3, it cannot be overemphasized that the same effectiveness is acquired.
[0053] (Gestalt 3 of operation) With the gestalt of this 3rd operation, a color filter layer is formed on a front substrate, and the case where a laminating is carried out to the soda lime glass plate carried out two quart of SiO(s), a transparent electrode, a bus electrode, a transparence dielectric layer, and a protective layer is explained. The cross-section structure of the panel at this time is shown in drawing 3 . Drawing 3 is equivalent to the cross section in the d-d' line of drawing 4 shown in the conventional example. Moreover, the rear-face substrate of drawing 3 carries out sequential formation of the data electrode 8, a septum 7, and the fluorescent substances 9R, 9G, and 9B on a glass substrate, as the conventional example showed. The discharge cel 11 which obtains each luminescent color consisted of a data electrode 8 and a field discharge electrode which the front substrate 1 which counters through a septum 7 has.
[0054] On the other hand, the front substrate 1 forms the color filter layers 4R, 4G, and 4B, a glass plate 14, a transparent electrode 2, the bus electrode 3, the transparence dielectric layer 5, and a protective layer 6.
[0055] First, the color filter layers 4R, 4G, and 4B are formed on the front substrate 1. Since it is the same as that of the gestalt of the 1st and the 2nd operation, the formation approach is omitted.
[0056] Next, a glass plate 14 is made to rival on this. With the gestalt of this operation, soda lime glass was used as a glass plate 14. Therefore, a glass plate 14 is SiO2 by the dip method beforehand. What coated the layer 12 was used. Moreover, although the object smaller than the front substrate 1 was used for the magnitude of a glass plate 14, it was made into the magnitude which the terminal area which pastes up FPC which connects a drive circuit and a panel can cover. Furthermore, since a glass plate 14 was fixed on the front substrate 1, it calcinated by applying the glass paste of a low-melt point point to the perimeter of a glass plate 14. The low-melting-glass paste used here used the same ingredient as the transparence dielectric layer 5 used behind. this is because the magnitude of a glass plate 14 is determined that all the electrodes formed on the front substrate 1 will come on a glass plate 14, so it is satisfactory especially even when the softening temperature of the part around a glass plate 14 and the

transparence dielectric layer 5 formed on an electrode is the same.
[0057] A transparent electrode 2 and the bus electrode 3 are formed on this glass plate 14. Since it is the same as that of the gestalt of the 1st and the 2nd operation, the formation approach is omitted.
[0058] After forming a transparent electrode 2 and the bus electrode 3, the transparence dielectric layer 5 is formed. It carried out with screen printing like the gestalt of the 1st and the 2nd operation as the formation approach of the transparence dielectric layer 5. However, what is necessary will be for there to be especially no constraint from the substrate which used the softening temperature of the glass frit of the transparence dielectric layer 5 used at this time for the bottom of a transparent electrode 2 unlike the gestalt of the 1st operation, and just to determine it from the relation between a transparent electrode 2 and the bus electrode 3. Burning temperature of this transparence dielectric layer 5 was made into 500-600 degrees C, and made thickness after baking about 30 microns. after forming this transparence dielectric layer 5 -- the transparence dielectric layer 5 -- the protective layer 6 which consists of MgO so that all may be covered is formed. MgO formed membranes with vacuum deposition, membrane formation temperature was made into about 200 degrees C, and thickness could be 0.5-1 micron.
[0059] Thus, the front substrate 1 is created and a panel is made combining the rear-face substrate 10. However, it cannot be overemphasized that it was made in agreement [each color of the color filter layers 4R, 4G, and 4B created to the front substrate 1 and the luminescent color of the fluorescent substances 9R, 9G, and 9B formed in the rear-face substrate 10].
[0060] When this panel was operated, it was not able to generate, and that of an electrode was not able to generate decline in poor withstand voltage and permeability, either, but could secure high bright place contrast and large color reproduction nature, and was able to cancel the rise of the driver voltage by the color filter, and the ununiformity of the driver voltage by each color filter ingredient (red, green, blue) further. Moreover, discoloration of a color filter layer did not occur, either.
[0061] Moreover, at the gestalt of this operation, it is SiO2 to the front substrate 1. It is SiO2 like [although a coat has not been carried out / when the highest burning temperature exceeds 550 degrees C among the production processes of a front substrate] the gestalt of the 1st operation. It is necessary to prepare a layer. Furthermore, although field discharge electrode 2H were formed by forming the bus electrode 3 on a transparent electrode 2 with the gestalt of this operation, even if it forms the bus electrode 3 previously, and it forms so that a transparent electrode 2 may next touch this bus electrode 3, it cannot be overemphasized that the same effectiveness is acquired.
[0062] Furthermore, when using alkali free glass as a glass plate 14, the front substrate 1 also needs to use alkali free glass, and it is necessary to change the component of the glass frit which is further contained in the bus electrode 3, the transparence dielectric layer 5, etc. This is because it is necessary to unite an expansion coefficient by the front substrate 1, the glass plate 14, the bus electrode 3, and the transparence dielectric layer 5.
[0063]
[Effect of the Invention] About the substrate which performs high temperature processing according to the color plasma display panel by this invention as explained above, it is SiO2. Form on a front substrate, it is made to function as alkali barrier, and discoloration of a color filter layer is suppressed. Moreover, after forming the transparence dielectric layer a after forming a color filter layer, and graduating a front face, a field discharge electrode, the transparence dielectric layer b, and a protective layer are formed. By having formed the transparence dielectric layer a on the color filter layer, a front face is graduated and trouble does not occur in subsequent transparent electrode formation or bus electrode formation. Moreover, the membrane formation temperature of a transparent electrode is about 250 degrees C or less, when membranes are usually formed by the sputtering method, and the burning temperature of the transparence dielectric layer a or the transparence dielectric layer b is 500-600 degrees C to it. For this reason, in case a transparent electrode is formed, the transparence dielectric layer a does not soften and problems, such as an open circuit of a transparent electrode, are not generated at the time of transparent electrode membrane formation. Furthermore, if the transparence dielectric layer a does not soften at the time of baking of the transparence dielectric layer b, an open circuit is not generated in the field discharge electrode which consists of a transparent electrode and a

bus electrode. As for the difference of the softening temperature of the transparence dielectric layer a and the transparence dielectric layer b required in order not to generate this open circuit, Table 1 in the gestalt of the 1st operation shows that it is 50 degrees C or more. That is, since an open circuit cannot be generated in a field discharge electrode, but the transparence dielectric layer b can be softened completely and air bubbles etc. will not be generated in the transparence dielectric layer b with the quality of the material in which the transparence dielectric layer a has softening temperature higher 50 degrees C or more than the transparence dielectric layer b if the transparence dielectric layer b is calcinated near the softening temperature of the transparence dielectric layer b, decline in poor withstand voltage and permeability does not occur, either. Moreover, since the membrane formation temperature of MgO which is a protective layer is usually around 200 degrees C, the transparence dielectric layer a and the transparence dielectric layer b do not soften in membrane formation of MgO.

[0064] Next, when structure of a front substrate is made into a color filter layer, a glass-ceramics layer, a field discharge electrode, a transparence dielectric layer, and a protective layer from a glass substrate side, even if a front face is graduated and it forms a color filter layer by having prepared the glass-ceramics layer on the color filter layer too, trouble does not occur in field discharge electrode formation at all. Furthermore, if glass ceramics calcinate at 500-600 degrees C, it will re-be hard coming to soften after baking. The front substrate in which a piece cannot be generated in a field discharge electrode because glass ceramics do not re-soften at the time of baking of the transparence dielectric layer further formed on a field discharge electrode at the time of membrane formation of a transparent electrode and formation of a bus electrode, but a transparence dielectric layer can be softened completely, consequently air bubbles etc. are not generated in a transparence dielectric layer, and decline in poor withstand voltage and permeability does not occur by this, either can be formed. Moreover, when carrying out high temperature processing of the substrate, it is SiO2 to a glass substrate. It forms and a deposit of the alkali metal from a glass substrate is suppressed.

[0065] Furthermore, when structure of a front substrate is made into a color filter layer, a glass plate, a field discharge electrode, a transparence dielectric layer, and a protective layer from a glass substrate side, even if a front face is smooth and it forms a color filter layer by having formed the glass plate on the color filter layer, trouble does not occur in field discharge electrode formation at all. Furthermore, a glass plate is not softened at the time of baking of the transparence dielectric layer further formed on a field discharge electrode at the time of membrane formation of a transparent electrode, and formation of a bus electrode, a piece cannot be generated in a field discharge electrode, a transparence dielectric layer can be softened completely, air bubbles etc. are not generated in a transparence dielectric layer, but the front substrate with which decline in poor withstand voltage and permeability does not occur, either can be formed. Moreover, when carrying out high temperature processing of the substrate, it is SiO2 to a glass substrate and a glass plate. It forms and a deposit of the alkali metal from a glass substrate is suppressed. Moreover, if alkali free glass is used as a glass plate, it will be SiO2 to a glass plate. There is no need of forming.

[0066] By this, since the color filter layer is not formed between a field discharge electrode and a transparence dielectric layer or in the interior of a transparence dielectric layer, the ununiformity of the electrostatic capacity by a color filter ingredient differing from red, green, and blue does not occur, but it crosses all over a panel, and a uniform drive can be performed.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the panel structure with especially sufficient high contrast and color reproduction nature of the color plasma display panel used for an information-display terminal, flat-surface mold television, etc.

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PRIOR ART

[Description of the Prior Art] A color plasma display panel is a display to which excitation luminescence is carried out and the display action of the fluorescent substance is carried out by the ultraviolet rays generated by the discharge in gases. It can divide into AC mold and DC mold from the gestalt of discharge. In this, AC mold is excellent in respect of [mold / DC] brightness, luminous efficiency, and a life, and the reflective mold AC side discharge mold is excellent in respect of brightness and luminous efficiency also in AC mold. The sectional view in the d-d' line of drawing 4 is shown for the perspective view of an example of the conventional reflective mold AC side discharge color plasma display panel in drawing 4 again at drawing 5 . The transparent electrode 2 of the shape of two or more stripe is formed in the front substrate 1 of transparent glass. In drawing 5 , two or more [of this transparent electrode 2] are formed perpendicularly at space. Between this adjacent transparent electrode 2, the pulse-like AC electrical potential difference of dozens of kHz to hundreds of kHz is impressed, discharge is generated, and a display action is performed.
[0002] In a reflective mold AC side discharge color plasma display, transparence electric conduction film, such as tin oxide (SnO2) and indium tin oxide (ITO), is usually used for a transparent electrode 2 so that [luminescence from a fluorescent substance] it may not be interrupted. However, the sheet resistance of these transparence electric conduction film is high, by the large-sized panel or the highly minute panel, electrode resistance becomes also more than several 10komega, an applied-voltage pulse does not fully start or a lifting drive becomes difficult about a voltage drop. Then, the bus electrode 3 by metal thickness film, such as metal thin films, such as a multilayered film of chromium / copper / chromium and an aluminum thin film, or silver, is formed in the part of a transparent electrode 2, and field discharge electrode 2H which consist of the transparent electrode 2 and the bus electrode 3 which lowered resistance are adopted as it.
[0003] On these field discharge electrode 2H, the color filter layers 4R, 4G, and 4B which consist of a stripe-like pigment impalpable powder layer so that it may intersect perpendicularly with field discharge electrode 2H are formed. Generally, the ingredient which has the optical property which penetrates only the luminescent color of the fluorescent substance layer 9 which this color filter layer 4 counters is chosen. Furthermore, this color filter layer 4 is covered with the transparent dielectric layer 5. This transparence dielectric layer 5 has the function of current limiting peculiar to AC mold plasma display. This is the function in which field discharge stops, when the potential by the electrical potential difference to which the field discharge which forms a capacitor by field discharge electrode 2H and the transparence dielectric layer 5, and is performed among [of two] field discharge electrode 2H is impressed by field discharge electrode 2H, and the charge stored in the transparence dielectric layer 5 by discharge denies exactly and there is. Thereby, the current has prevented flowing superfluously. Moreover, from reservation of withstand voltage, and the ease of carrying out of manufacture, the transparence dielectric layer 5 applies the paste which usually uses low melting glass as a principal component using thick film printing, and it carries out a reflow by calcinating at the elevated temperature beyond softening temperature temperature, and it forms it in the interior by the smooth thickness of 20 micrometers - about 40 micrometers which does not contain air bubbles etc.

[0004] Next, the protective layer 6 formed so that the whole transparence dielectric layer 5 may be covered is the thick film of MgO formed by the thin film of MgO or printing formed by vacuum evaporationo or the sputtering method, a spray method, etc. Thickness is about 1 micron from 0.5 microns. The roles of this protective layer 6 are reduction of discharge voltage, and prevention of a surface spatter.
[0005] On the other hand, the data electrode 8 of the shape of a stripe which writes in an indicative data is formed in the rear-face substrate 10. It is formed in the location corresponding to the red in which the data electrode 8 was formed in the direction parallel to space elongation and in the shape of [which this mentions later] a stripe, and the fluorescent substance layer 9 and each which emit light by the ultraviolet rays of discharge green and blue in drawing 5 . That is, the data electrode 8 lies at right angles to field discharge electrode 2H formed on the front substrate 1. The septum 7 was usually formed by thick film screen printing so that it might not lap with this data electrode 8, by carrying out thick film screen printing of the paste which usually becomes the upper part of a septum from metallic-oxide powder, low melting glass, etc., such as iron, chromium, and nickel, further etc., it colored black and reflection in a bright place is prevented. Moreover, a septum 7 has the effectiveness which prevents the discharge and the optical cross talk between the adjoining discharge cels. In drawing 5 , two or more [of this septum] are formed in parallel with space.
[0006] Furthermore, for every color, the fluorescent substances 9R, 9G, and 9B corresponding to red and the green and blue luminescent color are divided into 3 times, and are applied to the discharge cel 11 which consists of a septum 7, a front substrate 1, and a rear-face substrate 10. Each fluorescent substance is formed also in the side face of a septum 7, in order to increase fluorescent substance spreading area and to obtain high brightness. Screen-stencil is usually used for membrane formation of each fluorescent substance.
[0007] Then, it is made to counter through a septum and the hermetic seal of the perimeter is carried out so that field discharge electrode 2H of the above-mentioned front substrate 1 and the data electrode 8 of the rear-face substrate 10 may intersect perpendicularly, and the gas which can discharge inside the discharge cel 11, for example, the mixed gas of helium, and Ne and Xe, is enclosed by the pressure of 500torr extent.
[0008] In drawing 5 , two field discharge electrode 2H which become each discharge cel 11 from a transparent electrode 2 and the bus electrode 3 are arranged at a time, field discharge occurs in this gap section that is field discharge electrode 2H, and the plasma arises in each discharge cel. Fluorescent substances 9R, 9G, and 9B are excited by the ultraviolet radiation generated at this time, red and the green and blue light are generated, and display luminescence is obtained through the color filter layer 4 of the front substrate 1.
[0009] The lot of adjacent field discharge electrode 2H which generate field discharge takes charge of the duty of a scan electrode and a maintenance electrode, respectively. In the actual panel drive, the maintenance pulse is impressed between the scan electrode and the maintenance electrode. When generating write-in discharge, an electrical potential difference is impressed between a scan electrode and the data electrode 8, opposite discharge is generated, and maintenance discharge occurs among field discharge electrode 2H by the maintenance pulse to which this discharge is impressed succeedingly.
[0010] The body color of the fluorescent substance used with a color plasma display panel is usually the powder of white with a very high reflection factor. In a color plasma display panel, although outdoor daylight will be absorbed by the septum upper part or the bus polar zone if the light (outdoor daylight) of the interior of a room or the outdoors carries out incidence to a panel, 30% to about 50%, it is reflected and contrast is spoiled remarkably. In order to prevent this outdoor daylight reflection and to obtain the good display of contrast, the approach of arranging the ND filter of about 40 - 80% of permeability is also in a panel side, but since a part of visible luminescence from a fluorescent substance is also interrupted, there is a fault that panel brightness falls.
[0011] The approach using the color filter layer 4 as an approach of suppressing reflection of outdoor daylight is proposed from the former, without reducing panel brightness as much as possible. This forms the color filter layer 4 which penetrates red and a green and blue light to the front substrate 1 side

corresponding to red and the luminescent color from each green and blue discharge cel. High color reproduction nature can be obtained to high contrast and coincidence by this.
[0012] However, as mentioned above, the dielectric layer 5 has the function of current control peculiar to AC mold plasma display. It is greatly dependent on the dielectric constant and thickness of the transparence dielectric layer 5, and this current control function forms the capacitor by field discharge electrode 2H and the transparence dielectric layer 5. However, if the color filter layer 4 is formed between field discharge electrode 2H and the transparence dielectric layers 5 and in the interior of the transparence dielectric layer 5, electrostatic capacity will become that in which the transparence dielectric layer 5 and the color filter layer 4 carried out serial composition. The color filter layer 4 consists of ingredients different, respectively which enable the transparency only of red and green and blue colored light. For example, the following can be considered as red and a green and blue pigment. red: -- Fe 2O3 system green: -- CoO-aluminum2 O3-Cr 2O3 system blue: -- CoO-aluminum 2O3 a system -- dielectric constants differ with each ingredient of each [these] color. That is, the electrostatic capacity which consists of a transparence dielectric layer 5 and a color filter layer 4 in each color will differ, the electrical potential difference by which a current control function and field discharge are started as a result changes with each colors, and a uniform drive becomes very difficult. Moreover, the rise of driver voltage also breaks out.
[0013] JP,6-5202,A is known as an AC mold plasma display using the color filter for solving this problem.
[0014] According to this technique, a color filter layer and a black matrix are formed on a front plate, and the electrode is formed on it. However, if an electrode is directly formed on a color filter layer and a black matrix as this technique has described, an electrode will go out with the irregularity by the color filter layer and black matric. If the electrode is formed by thin film technologies, such as the sputtering method, the thickness is about 1-2 micrometers at the maximum. However, in this thickness, an electrode will go out with the irregularity formed by the color filter layer and black matric. If a dielectric layer will be printed and it will be calcinated on an electrode even if a piece is not generated at the time of membrane formation, when expansion of the color filter layer 4 and the transparence dielectric layer 5 differs, it is clear for a piece to be generated in an electrode and not to function on it as an electrode. Moreover, for irregularity with a color filter layer and a black mask, supposing it is formed with thick-film techniques, such as screen printing, although printed by the part of a convex, the phenomenon in which it is not printed will occur, a piece will be too generated in an electrode, and the part of concave cannot perform the work as an electrode.
[0015] Moreover, a color filter is formed on a front substrate at JP,3-196446,A, a it top is covered by transparence glass membrane, and the technique which forms an electrode on the transparence glass membrane is shown. This technique is DC mold color plasma display panel, and it is impossible to apply this to a direct AC mold. It is because there is the need of forming on an electrode the transparence dielectric layer which uses glass as a principal component, in AC mold color plasma display panel. The transparence glass membrane by this technique applies a paste, and forms it by calcinating at 580 degrees C. If the temporarily same quality of the material as the transparence glass membrane currently used for the bottom of a color filter layer is formed also on an electrode and it calcinates at the same temperature, a piece will be generated in an electrode or a color filter layer. Though an electrode is the quality of the material formed by the thin film technology by the sputtering method etc., even if this is formed with thick-film techniques, such as screen printing, it is the same. The burning temperature of the transparence glass membrane formed on an electrode is because it must be more than the softening temperature of the glass component contained during this paste. If this burning temperature is lower than softening temperature, the transparence glass membrane on an electrode will not carry out a reflow completely, but air bubbles etc. exist in the film, and it becomes a poor proof pressure and the cause of a permeability fall. Therefore, the burning temperature of the transparence glass membrane on an electrode must be the temperature more than softening temperature. However, since the softening temperature of the transparence glass membrane used for the bottom of an electrode is the same as the object used on the electrode, when calcinating and carrying out a reflow of the transparence glass

membrane on an electrode, a re-reflow also keeps the transparence glass membrane under an electrode as **, and, as a result, a piece generates it in an electrode or a color filter layer. Therefore, the ingredient with which the softening temperatures of the transparence glass membrane which forms this technique on an electrode the bottom of an electrode when adapted for AC mold differed must be used. However, according to this technique, that is not suggested at all. Moreover, if a color filter layer is formed on a front substrate and 580 degrees C is calcinated at a subsequent process, alkali metal (mainly Na) will deposit from a glass substrate, and discoloration of a color filter layer will occur. However, it is not suggested at all about this thing.

[0016] Furthermore, a color filter is formed on a front substrate at JP,4-352104,A, a it top is covered by the protective coat (thermosetting matter), and the transparence electric conduction film is formed on it. However, when membrane formation temperature of T1 and the transparence electric conduction film is set to T2 for the membrane formation temperature of a protective coat, the technique characterized by filling T1 >=T2 is indicated. This is a technique for preventing gas's occurring [causes of generating, such as KAKE of a transparent electrode, separation, and poor adhesion,] from a protective coat at the time of transparence electric conduction film membrane formation, or the hardening reaction of a protective coat advancing at the time of transparence electric conduction film membrane formation, and the volumetric shrinkage or cubical expansion of a protective coat happening, and generating Siwa, a swell, an opening, etc. in the critical field of a protective coat and the electric conduction film. However, supposing it applies this technique to AC mold color plasma display panel, the following problems will occur. That is, it is necessary to form a dielectric layer on the transparence electric conduction film in AC mold color plasma display panel. This is because it is necessary to form a capacitor by the electrode and the dielectric layer as mentioned above. When burning temperature of the dielectric layer temporarily formed on the transparence electric conduction film is made into T3, in order not to make the transparence electric conduction film generate a crack, it is T1>T3 and it is important a volumetric shrinkage, cubical expansion, or that a protective layer does not soften at burning temperature T2 (membrane formation temperature of the transparence electric conduction film), and T3 (burning temperature of a dielectric layer). That is, if the substrate of the transparence electric conduction film moves, it will lead to the crack of the transparence electric conduction film. Therefore, when forming the transparence electric conduction film between a protective layer and a dielectric layer, the protective layer of important one is a volumetric shrinkage, cubical expansion, or the temperature to soften. However, this thing is not suggested to this technique at all.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] About the substrate which performs high temperature processing according to the color plasma display panel by this invention as explained above, it is SiO2. Form on a front substrate, it is made to function as alkali barrier, and discoloration of a color filter layer is suppressed. Moreover, after forming the transparence dielectric layer a after forming a color filter layer, and graduating a front face, a field discharge electrode, the transparence dielectric layer b, and a protective layer are formed. By having formed the transparence dielectric layer a on the color filter layer, a front face is graduated and trouble does not occur in subsequent transparent electrode formation or bus electrode formation. Moreover, the membrane formation temperature of a transparent electrode is about 250 degrees C or less, when membranes are usually formed by the sputtering method, and the burning temperature of the transparence dielectric layer a or the transparence dielectric layer b is 500-600 degrees C to it. For this reason, in case a transparent electrode is formed, the transparence dielectric layer a does not soften and problems, such as an open circuit of a transparent electrode, are not generated at the time of transparent electrode membrane formation. Furthermore, if the transparence dielectric layer a does not soften at the time of baking of the transparence dielectric layer b, an open circuit is not generated in the field discharge electrode which consists of a transparent electrode and a bus electrode. As for the difference of the softening temperature of the transparence dielectric layer a and the transparence dielectric layer b required in order not to generate this open circuit, Table 1 in the gestalt of the 1st operation shows that it is 50 degrees C or more. That is, since an open circuit cannot be generated in a field discharge electrode, but the transparence dielectric layer b can be softened completely and air bubbles etc. will not be generated in the transparence dielectric layer b with the quality of the material in which the transparence dielectric layer a has softening temperature higher 50 degrees C or more than the transparence dielectric layer b if the transparence dielectric layer b is calcinated near the softening temperature of the transparence dielectric layer b, decline in poor withstand voltage and permeability does not occur, either. Moreover, since the membrane formation temperature of MgO which is a protective layer is usually around 200 degrees C, the transparence dielectric layer a and the transparence dielectric layer b do not soften in membrane formation of MgO.
[0064] Next, when structure of a front substrate is made into a color filter layer, a glass-ceramics layer, a field discharge electrode, a transparence dielectric layer, and a protective layer from a glass substrate side, even if a front face is graduated and it forms a color filter layer by having prepared the glass-ceramics layer on the color filter layer too, trouble does not occur in field discharge electrode formation at all. Furthermore, if glass ceramics calcinate at 500-600 degrees C, it will re-be hard coming to soften after baking. The front substrate in which a piece cannot be generated in a field discharge electrode because glass ceramics do not re-soften at the time of baking of the transparence dielectric layer further formed on a field discharge electrode at the time of membrane formation of a transparent electrode and formation of a bus electrode, but a transparence dielectric layer can be softened completely, consequently air bubbles etc. are not generated in a transparence dielectric layer, and decline in poor withstand voltage and permeability does not occur by this, either can be formed. Moreover, when carrying out high temperature processing of the substrate, it is SiO2 to a glass substrate. It forms and a

deposit of the alkali metal from a glass substrate is suppressed.

[0065] Furthermore, when structure of a front substrate is made into a color filter layer, a glass plate, a field discharge electrode, a transparence dielectric layer, and a protective layer from a glass substrate side, even if a front face is smooth and it forms a color filter layer by having formed the glass plate on the color filter layer, trouble does not occur in field discharge electrode formation at all. Furthermore, a glass plate is not softened at the time of baking of the transparence dielectric layer further formed on a field discharge electrode at the time of membrane formation of a transparent electrode, and formation of a bus electrode, a piece cannot be generated in a field discharge electrode, a transparence dielectric layer can be softened completely, air bubbles etc. are not generated in a transparence dielectric layer, but the front substrate with which decline in poor withstand voltage and permeability does not occur, either can be formed. Moreover, when carrying out high temperature processing of the substrate, it is SiO2 to a glass substrate and a glass plate. It forms and a deposit of the alkali metal from a glass substrate is suppressed. Moreover, if alkali free glass is used as a glass plate, it will be SiO2 to a glass plate. There is no need of forming.

[0066] By this, since the color filter layer is not formed between a field discharge electrode and a transparence dielectric layer or in the interior of a transparence dielectric layer, the ununiformity of the electrostatic capacity by a color filter ingredient differing from red, green, and blue does not occur, but it crosses all over a panel, and a uniform drive can be performed.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the case of AC mold color plasma display panel, as mentioned above, a transparence dielectric layer has a current control function, and is a very important part. If a color filter layer is formed between a field discharge electrode and a transparence dielectric layer and in the interior of a transparence dielectric layer, the electrostatic capacity of a transparence dielectric layer will become that in which the transparence dielectric layer and the color filter layer carried out serial composition. However, it is blue, and red, green, and since it differs, these electrostatic capacity will differ in each color, and, as for the ingredient of a color filter layer, uniform actuation becomes difficult by this at the time of the drive of a panel. Moreover, the rise of driver voltage also breaks out.
[0018] Moreover, if a color filter layer is first formed on a front substrate and a field discharge electrode is formed on it in order to avoid this, with the irregularity of a color filter layer and the black matrix film, a piece will be generated in a field discharge electrode and the function as an electrode will become impossible.
[0019] Furthermore, when the ingredient same when an electrode is further formed on it after forming a color filter layer and the black matrix film on the front substrate and forming transparence glass membrane on it as the thing in which the glass membrane which forms this as a dielectric layer on an electrode temporarily when adapted for AC mold color plasma display panel was formed to the bottom of an electrode is used, the following problems occur. When the burning temperature of the transparence glass membrane on an electrode is calcinated at the temperature more than softening temperature, even if the temperature is lower than the burning temperature of the transparence glass membrane formed in the bottom of an electrode, a re-reflow of the transparence glass membrane under an electrode will be carried out, therefore a piece will be generated in an electrode. Moreover, when the burning temperature of the transparence glass membrane on an electrode is calcinated at temperature lower than softening temperature, a reflow cannot be carried out, but, as a result, air bubbles are generated in transparence glass membrane, and the glass membrane on an electrode becomes decline in permeability, and the cause of poor withstand voltage.
[0020] This invention offers AC mold color plasma display panel using the color filter which can realize this structure by determining correlation of the quality of the material of the protective layer at the time of carrying out a laminating to a color filter layer, a protective layer, a field discharge electrode, and a transparence dielectric layer, and the quality of the material of a protective layer and a transparence dielectric layer on a front substrate.

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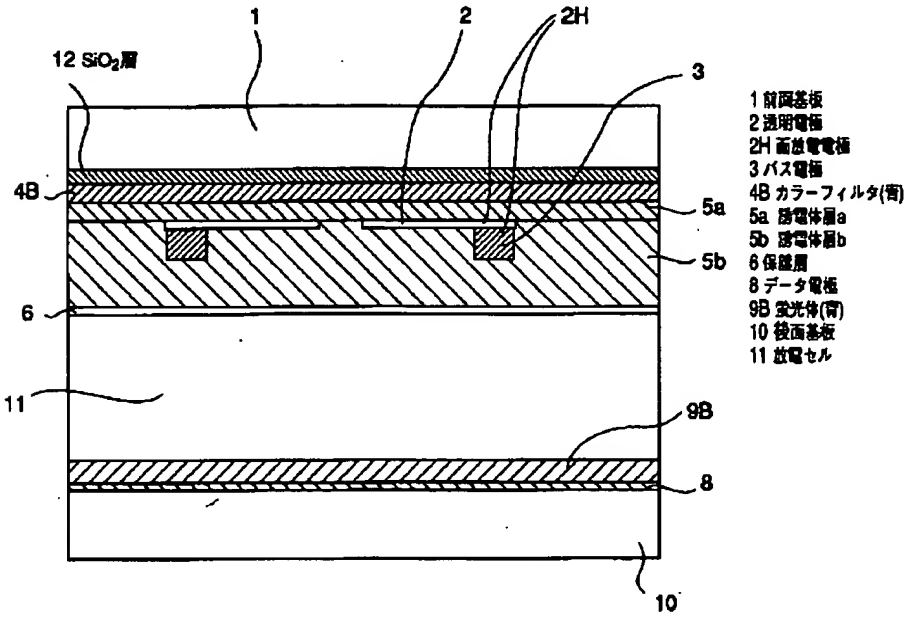
DESCRIPTION OF DRAWINGS

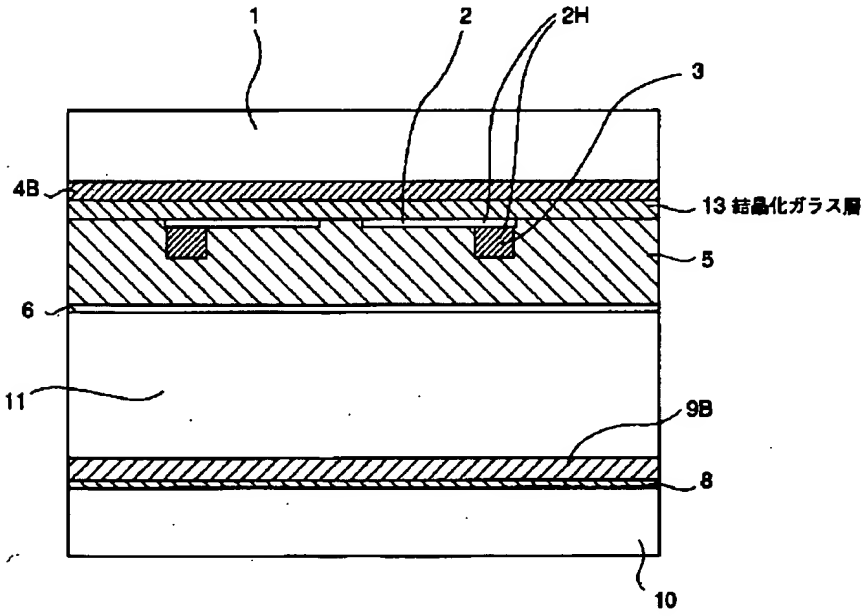
[Brief Description of the Drawings]
[Drawing 1] It is the sectional view of the color plasma display panel by the gestalt of operation of the 1st of this invention.
[Drawing 2] It is the sectional view of the color plasma display panel by the gestalt of operation of the 2nd of this invention.
[Drawing 3] It is the sectional view of the color plasma display panel by the gestalt of operation of the 3rd of this invention.
[Drawing 4] It is the perspective view of the conventional color plasma display panel.
[Drawing 5] It is the sectional view of the conventional color plasma display panel.
[Description of Notations]
1 Front Substrate
2 Transparent Electrode
2H Field discharge electrode
3 Bus Electrode
4 Color Filter Layer
4R Red color filter layer
4G Green color filter layer
4B Blue color filter layer
5 Dielectric Layer
5a Dielectric layer a
5b Dielectric layer b
6 Protective Layer
7 Septum
8 Data Electrode
9 Fluorescent Substance Layer
9R Red fluorescent substance layer
9G Green fluorescent substance layer
9B Blue fluorescent substance layer
10 Rear-Face Substrate
11 Discharge Cel
12 SiO2 Layer
13 Glass-Ceramics Layer
14 Glass Plate

[Translation done.]

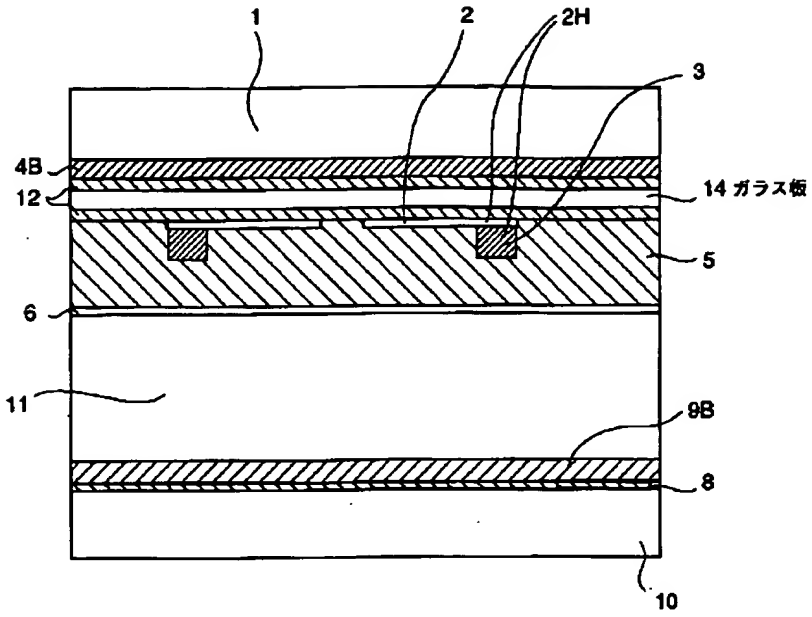
[Drawing 1]



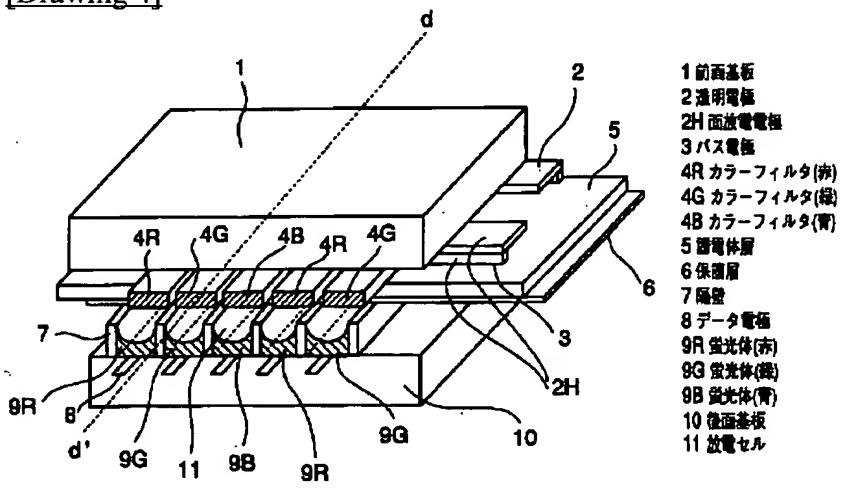
[Drawing 2]



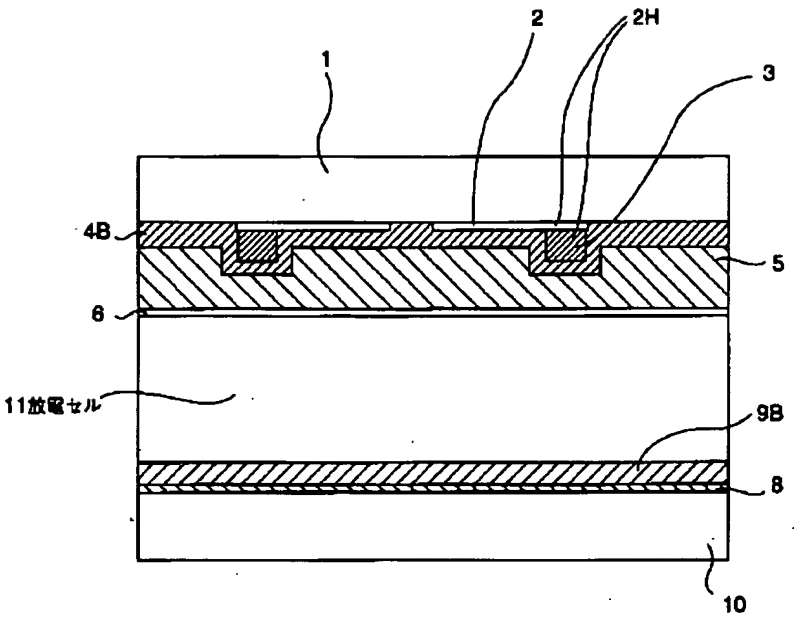
[Drawing 3]



[Drawing 4]



[Drawing 5]



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